



The migration to IP from analog affects dome performance. High-resolution cameras, fisheye lenses and network constraints influence optimal dome operation.

BY LING-MEI WONG

Tuning Domes for Top IP Performance

Higher resolution dome cameras enable greater detail, but also introduce network issues. In turn, networks facilitate greater connectivity, but may also incur lag. One consideration for IP devices is the cabling distance, which was rarely an issue for analog, said Andrew Pigram, Technical Director at Norbain.

Latency for network dome controls is about 300 milliseconds, due to IP traffic constraints and compression requirements, said Ian Crosby, Product Marketing Manager for CCTV, Bosch Security Systems. This is barely discernible to operators but can be exacerbated if the network cannot withstand video surveillance traffic.

BIG-PICTURE DOMES

Network domes include newer megapixel and HD models, which provide greater image clarity but add to the processor load. Depending on what processor is used, a true high-resolution dome may have few other functions to prevent image lag, said Alf Chang, Senior Consultant for *A&S* magazines. A high-resolution dome may have to

sacrifice image correction or analytics to free up processing power. The CPU will be taxed further if the dome offers dual or triple streaming, limiting the functional performance of high-resolution domes.

The top end for high-resolution domes is around 2-megapixel or 1080p HD, as real-time frame rates are still feasible. "The standard in HD is emerging as 720p, because 720p is 1.3-megapixel, which is still four times the image content of analog; so, it's pretty good," Pigram said.

Low-light performance is another consideration for high-resolution cameras, with CCDs delivering consistent results. "They tend to be 1.3-megapixel in resolution," Pigram said. "Four- or 5-megapixel technology tends not to be real-time and is typically more like 15 fps. High megapixel count might not be suitable for areas with a lot of movement or low light levels, as the price for resolution is sensitivity."

FINE DETAIL

Despite resolution and processor constraints, more pixels do make a noticeable difference. "In many events, when the police went back through

footage, the images were not usable," said Allen Yang, PM at Etrovision Technology. "High-resolution cameras can do real identification."

HD at 1080p increases the viewing area of standard definition (SD) by six times. "If you zoom in on a D1 image, you will get less detail, but full HD offers greater clarity," said Garrett Li, Marketing Manager at DynaColor.

A single megapixel or HD camera can save installers time. "In surveillance, the highest cost is installation," Yang said. "With a 5-megapixel dome, if you have a wide area, you just need one camera. It's expensive but replaces many D1 cameras and reduces installation costs."

CONSUMER STANDARD

Higher resolution sometimes does not necessarily mean fewer cameras. "I've seen projects that went from SD to HD and kept the same number of cameras," said Jeff Corral, Product Line Manager for Edge Devices, March Networks. "Since HD is already in the consumer market, it is heading toward the economy of scale of analog. People don't use NTSC or PAL on their TV as much anymore, and in some devices, those standards are disappearing altogether."

Other vendors felt that HD's

advantage lies in enhancing surveillance, rather than replacement of SD cameras. "HD delivers more details per meter than SD and as such produces far better identification and recognition data at the same surveillance range, compared to an SD camera," Crosby said.

For example, an HD sensor increases the number of pixels per meter, compared to an SD one using the same focal-length lens. As every doubling in resolution doubles the effective distance for focal length, an SD camera with a 36x lens delivers almost the same performance as an HD one with a 20x lens. "Greater surveillance range and more details delivered at the same range are, therefore, a performance leap, rather than a simple cost-reduction exercise," Crosby said.

The standardization of HD has given it an edge over megapixel. "Megapixel has no standard; you don't have a screen for the 4:3 format any more," said Iida Atsushi, PM of Security Solutions, Business and Professional Products for APAC, Sony Electronics. "That's why this year we didn't provide any SD cameras — they are all HD."

While network HD and megapixel domes boost resolution, they cost more for smaller installations. "Some

people are very happy with analog for their system; others have the infrastructure and requirement for IP," said James Smith, European Marketing Manager, Samsung Techwin. "We look at what a dome has to achieve for the user and offer our customers a choice to do that."

Increased storage demand from megapixel recording requires bandwidth management options. "If you're looking at a street, you can select a portion at a higher resolution, and the rest at a lower resolution," Smith said. "Multiple streams are also available so that video at different resolutions can be sent to different devices simultaneously if required. We can record events onto built-in memory cards in high resolution and stream live images to a control center in a lower resolution."

Not every high-resolution dome has to be IP, as the HDcctv standard sends 720p and 1080p streams over existing coaxial cables. However, storage requires the dome to connect to an embedded HDcctv DVR, which is limited by a certain number of terabytes and is harder to expand compared to network storage, said Rich Huang, PM at EverFocus Electronics.

HEMISPHERIC DOMES

Hemispheric or fisheye cameras give operators a bird's-eye view on a scene. Any events that take place behind a fixed lens will not be captured; the fisheye lens overcomes this limitation.

However, fisheye cameras have sensitivity issues, which make them unsuited for outdoor applications. "The low-light performance is worse," Atsushi said. Because of the lens optics, hemispheric domes are



Allen Yang, PM at Etrovision Technology



Garrett Li, Marketing Manager at DynaColor



Iida Atsushi, PM of Security Solutions, Business and Professional Products for APAC, Sony Electronics

better suited for indoor installations in brightly lit areas.

The dewarping software for fisheye domes must transform the spherical dome image into a rectangular format for displays. “Hemispheric cameras enable users to see a big area,” said Erik Frännlid, Director of Product Management, Axis Communications. “Unfortunately, the resulting resolution is low in pixels per square meter since the number of available pixels is spread over a huge area. Zoom can only be done digitally, and the result is a very low and, usually, unusable resolution.”

OPERATION CONCERNS

POE DOME CONTROLS

PoE or high PoE simplifies installation, as it eliminates the need for a separate power cable. “Only one standard Cat-5 cable is needed for carrying power, as well as video and PTZ controls,” Frännlid said. Standard PoE (802.3af) is about 15 watts, while high PoE (802.11at) goes up to 30 watts.

The limited power from standard PoE is insufficient for driving most pan-tilt dome motors. “IP manufacturers are increasingly making domes work at lower power consumption,” Pigram said. “They’re not quite fully functional and tend to be for internal use.”

Outdoor PTZ domes are a challenge for PoE, due to range and power requirements. “We see PoE and high PoE as very useful for indoor junior domes but of limited use outdoors, due to the power needed to run heaters and the losses due to the distance from the power source,” Crosby said. Heated domes could use as much as 50 to 60 watts — power that PoE cannot deliver yet.

Finding the right network switch



▲ Network domes are better suited for indoor installations, since they are limited by power and distance constraints.

for standard PoE is not a problem, but gets trickier for high PoE. “There are PoE solution vendors who provide higher power through nonstandard solutions, but those are not as easy to obtain as a standard solution and are generally cost-prohibitive,” Corral said.

INTELLIGENT NETWORKS

Along with transmission, smooth dome operations depend on network infrastructure. “You must design the network efficiently so you don’t get problems with latency,” Pigram said. This means the right storage solution is used so users can record according to their needs.

Network domes enable more management options, depending on operator preference. Dome controls should integrate a user-friendly

interface. “Some have virtual keyboards on the screen; some people integrate analog keyboards; and some are happy with a mouse to click on the screen,” Pigram said.

As IP replaces analog, there is less reliance on traditional methods of controlling cameras with keyboards and joysticks. “With higher resolutions and integration with other security systems — like access control, analytics that can detect and alarm on predefined events, and faster access to recorded video — there is less need to actually have a person watch video screens, and customers are, therefore, changing the way they interact with their security systems,” said Dave Stanfield, Senior Product Marketing Manager at Pelco (a Schneider Electric company). “Having said

that, there are still applications where real-time monitoring is important. In those cases, we continue to see the need for very precise, low-latency controls afforded by analog capabilities. These applications typically result in a hybrid system that is digital on the recording side, but analog on the control side.”

Advances in processing mean analytics are becoming a standard feature for network domes. “Motion, tamper, movement, trip wire — those kinds of detection will be built in,” Pigram said. However, false alarms make analytics helpful but not a must-have.

Video analytics should be critically evaluated. “Analytics-driven alarming has to be very carefully applied and should not be the only source that one relies upon in critical environments,” Stanfield said.

CHALLENGES AND TRENDS

Dome installation involves the physical labor of installers, who will usually scale great heights to place them. Reducing installation time is helpful, with more ergonomic designs or domes that come completely assembled out of the box.

Another trend is greater integration capabilities. “My advice to manufacturers has got to be ease of installation and integration,” Pigram said. “For installers and end users, it’s all well and good to put in IP, but how to expand is the question.” Compatibility between IP devices can cause problems for future upgrades, which could get expensive as systems grow.

Interoperability standards such as ONVIF and PSIA promise to streamline the integration of domes with third-party VMS and storage. “The cost of basic network

technology is still quite high compared to analog,” Pigram said. “You can’t plug and play in the same way. ONVIF is emerging as the standard of choice in Europe, although ONVIF versions 1.01 and 1.02 are not backward compatible, which is somewhat confusing.”



James Smith, European Marketing Manager, Samsung Techwin



Dave Stanfield, Senior Product Marketing Manager at Pelco (a Schneider Electric company)

TECHNICAL ISSUES

Domes offer installation advantages, but bubbles limit lens size. “The better the lens, the bigger it is,” Yang said. “But a dome cannot be huge. So in a limited space, you need to deliver a greater field of view.”

Pan and tilt controls for very high zoom lenses require great precision. The more the device moves, the harder it is to get the positioning on the motors accurate enough to match that high of a zoom, Stanfield said. “The smallest movement on a pan-tilt camera zoomed out far enough could move 20 to 30 feet, so it’s hard to keep things in view.”

Market demand is growing for smaller PTZ domes. With more components fitting snugly together, another challenge is developing cameras for extremely high operating temperatures, Frännlid said.

Bubble materials will face higher scrutiny, as plastic’s insufficient clarity affects how light passes through. “The bubble in a traditional dome is actually another lens,” Stanfield said. “As the industry moves to resolutions above 1.3-megapixel, manufacturers of PTZ domes have to start looking at bubbleless designs. Bubble clarity is not nearly as important for fixed domes as for movable domes

because they only look through a small area of the bubble. But when you zoom in and out, or pan and tilt, the relationship of the lens to the bubble changes. It’s then that the higher resolution reveals the imperfections of the plastic.”

HERE TO STAY

Domes provide an unimpeded view, with increased adoption in traffic monitoring. Speed domes in particular will see strong uptake, Huang said.

Smarter analytics and resolution increases will yield more accurate video analytics for domes. “These advances will allow us to move reliable analytic use from perimeter protection to crowded scenes in the next five years,” Crosby said.

Domes have enjoyed steady usage for surveillance. As technical improvements have overcome positioning and mount problems, quality domes can perform reliably. However, site-specific concerns should be factored into product selection, with IP infrastructure affecting network dome performance. Understanding how dome parts work together and how to prevent failure will go a long way toward smooth dome performance.

